

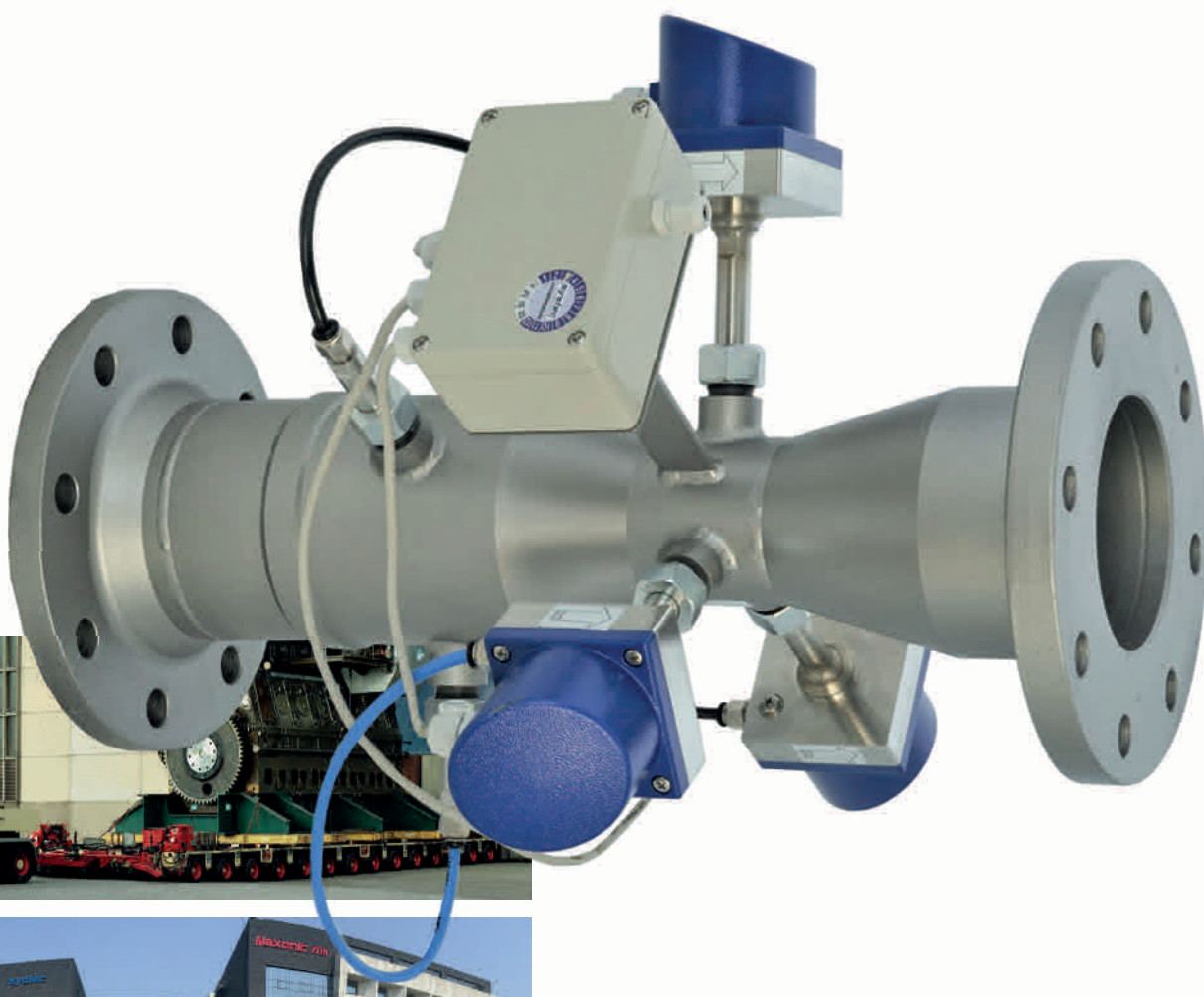
deltaflowB

## Flow master

Exhaust gas, air and gas reference measurements for engine-, Turbo and fuel cell test benches

# deltaflowB

made by systec



**systec**  
CONTROLS

deltaflowB flow reference measuring systems are used wherever accuracy, reliability, robustness and verifiability of measured values are required, e.g. in engine development, on turbocharger test benches, in the characterisation of exhaust systems or optimisation of fuel cells.

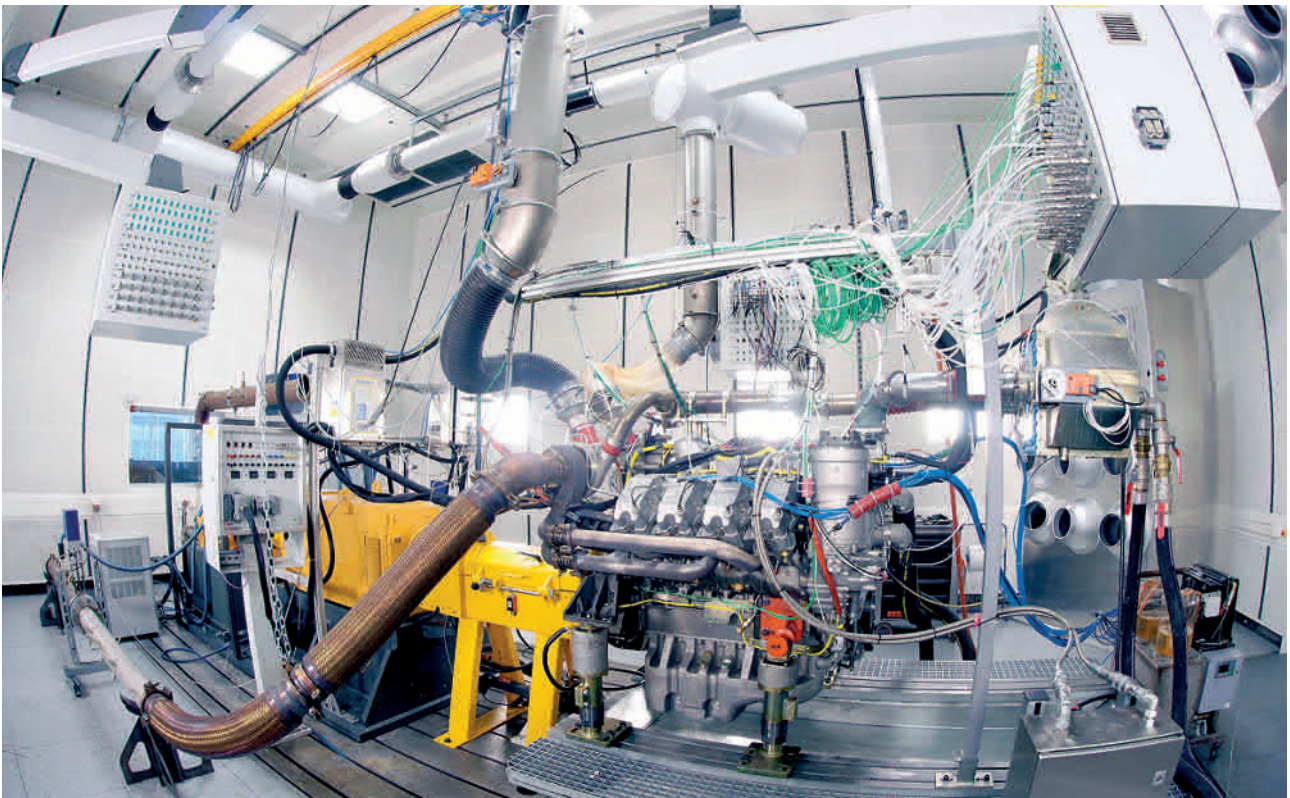
What these applications have in common is that the demands on the measuring system go far beyond normal requirements: There is pulsation, temperature, pressure and the media are contaminated. Standard measuring methods such as thermal flow meters, turbines, vortex or ultrasonic meters provide good accuracies under stationary conditions and with clean media, but fail under the tough test bench conditions.

The deltaflowB sensor family offers flow meters specially optimised for the various applications, which meet the requirements on the test bench in the long term, are low-maintenance and have perfect accuracy with long recalibration intervals. This makes deltaflowB measurements extremely economical to purchase and operate.

**First consultation, then engineering, then delivery and not vice versa.**

Especially in flow measurement technology, „reaching into the drawer“ usually leads to inadequate results. The number of flow measurement methods and their application limits can hardly be surveyed by the normal user. Manufacturer documentation does not point out what a measuring method cannot handle, but only shows the „positive limits“ of the devices. At systec, we guarantee you perfect advice in which we understand your requirements and clearly show you the application limits.

Only after fully understanding your requirements, our engineering department starts to design your sensor exactly for application and we discuss your individual offer with you. Once all points have been clarified and you have placed an order with us, your individual sensor will be built and delivered. Sounds expensive and like a long delivery time: Wrong! We have been „custom builders“ for over 25 years and supply flow measurement technology to all industries as well as for safety and billing applications. We can „only“ do flow, but we do it very well - at prices that are usually lower than those of our competitors.



# FlowB

Applications not only for the automotive industry



## Applications

deltaflowB measuring systems measure the flow in a wide variety of applications. The measuring system is always adapted to your specific requirements by our specialists.

## Fresh air to the engine

The fresh air measurement is the leading measurement for the gas flows on the engine test bench. Precision, repeatability and reliability are particularly important for this measurement. An inaccurate fresh air measurement leads to incorrect overall balances and massively hinders engine optimisation.

Thermal flow meters are still used on many older test beds, which are sometimes recalibrated every 3 months due to their sensitivity to any contamination and drift. In addition, thermal flow meters are pulsation-sensitive, which makes complex filters and dampers necessary and worsen the pressure loss and the dynamics of the measuring system.



Triple redundant measured value analysis

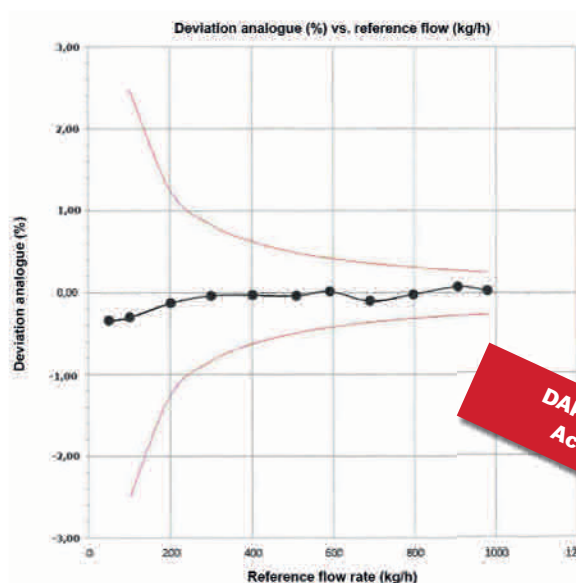
## deltaflowB air measurements

deltawaveB solves the requirements ideally: In the measuring section, three redundant pitot probes work completely digitally with a CAN-based evaluation. Due to the high sampling rate of > 2kHz, the measurement is insensitive to pulsations, transient measurements are perfectly recorded. The dp-based sensor technology is highly drift-stable, which allows long recalibration intervals. In addition to the flow rate, pressure and temperature are also measured and transmitted. The evaluation computer transmits the measured values digitally via CAN or via analogue outputs. All measured variables are monitored with OBD and clearly displayed on the measuring screen.

### Advantages:

- Large measuring range
- Accuracy from 0.5% of the measured value
- Unresponsive to pulsation, condensation and contamination
- Low drift, long calibration intervals (2 years)
- Triple redundant, OBD
- High dynamic, 2kHz sampling rate
- CAN bus and analogue I/O

## Calibration curve



DAkKS calibration results deltaflowB





## deltaflowB for Blow-By and EGR



### Blow-by and EGR mass flow measurements

The blow-by measurement (crankcase ventilation) provides information on the gas slip at the cylinders and valves and is thus an important measure of engine wear or series production capability. EGR (exhaust gas recirculation) is an important gas flow for NOx reduction on the engine.

Both blow-by and EGR are particle and condensate laden and have very strong pressure and flow pulsations, sometimes even with flow reversal.

The DF8 measuring section is ideal for these applications.

The DF8 reacts insensitive to oil mist and other condensates and withstands the highest temperatures. In addition, the DF8 can be dismantled and cleaned in just a few steps. The orifice element can be easily replaced if a different measuring range is required. Due to its compact design, the DF8 can be easily accommodated on the engine.

#### Advantages:

- compatible with high condensate and particle loads
- accuracy from 1% f.s.
- Easily dismantled for cleaning
- Flow measuring range easily adjustable by changing the throttle, 0.1kg/h to 500kg/h
- Up to 1000°C and 14bara
- Digital accuracy through CAN transmission

The evaluation and measured value transmission takes place purely digitally via CAN bus. To reliably protect the sensors from temperature, pressure surges and condensates, the measurement is connected to the evaluation via hoses (up to 5m). In the stainless steel cabinet, condensates are safely separated and pressure surges are reduced by damping tanks. This enables precise and safe long-term measurements. The measurement dynamics of the damping tanks can be easily adapted to the requirements.

Works with extreme pulsation and contamination up to over 500°C

# FlowB

## deltaflowB - Measurement of smoke and exhaust gases

### Exhaust gas mass flow measurement

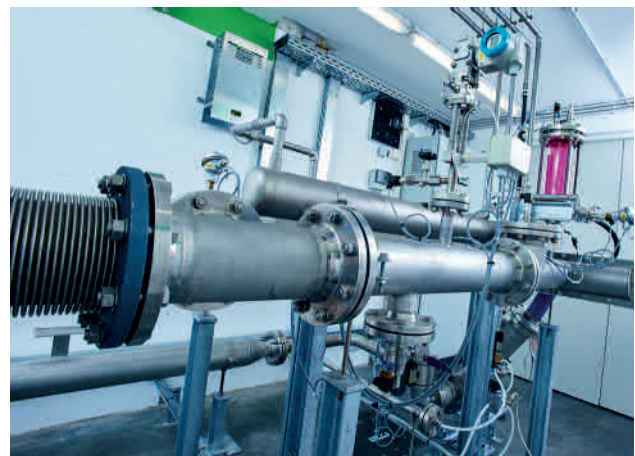
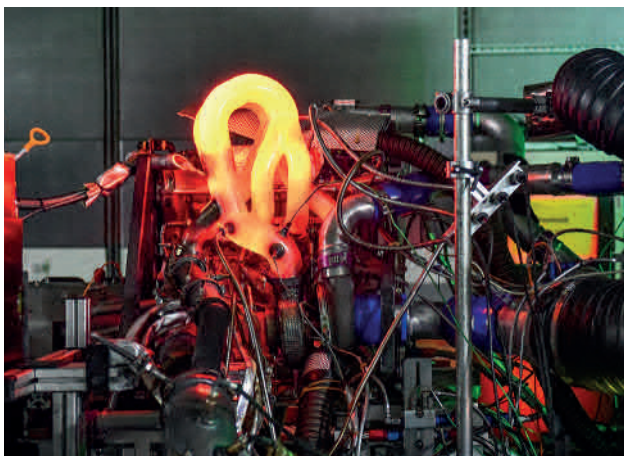
On the engine test bench, the measurement of the exhaust gas flow is an important variable in order to check the overall balance on the engine. Leakages and incorrect air are difficult to isolate on the test bench, but can massively falsify the complete test bench results. In order to exclude this frequent error, a closed balance of fresh air, fuel and exhaust gas is indispensable.

The requirements for exhaust gas measurement are similar to those for fresh air measurement, but NHCs and condensates are also found in the exhaust gas, and exhaust gases are also hot. The deltaflow DF25 measuring sections offer perfect accuracy of up to 0.5% and high robustness against contamination. The patented flow profile guarantees the highest linearity and is also insensitive to inlet disturbances due to the multi-point pressure measurement.

#### Advantages:

- Exhaust gas measuring section up to 1200°C
- High compatibility to condensates, ashes and NHC's, easy to clean
- Accuracy from 0.5% FS, long recalibration interval of min. 2 years
- Low pressure losses

The measuring sections are supplied fully calibrated, with DAkkS certificate on request.



## deltaflowC venturis for small flows

### Fuel cells

In the development of fuel cells, the measurement of the air volume on the cathode side is an important variable. For this application, systec supplies deltaflowC miniature venturis for the test bench or CAN-based TFI4B venturis for pre-series and series use.

The venturis are dimensioned so that the measuring range and pressure loss optimally fit the stack. The deltaflowC venturi is extremely compact and can be equipped with analogue or CAN output. Like all systec flowmeters, the deltaflowC reacts insensitive to surface contamination and condensates.



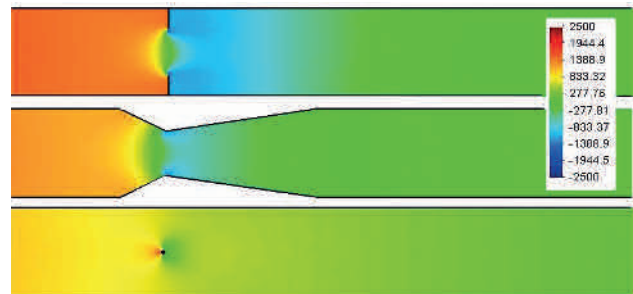
### Advantages:

- Accuracy from 1% FS, with calibration certificate
- To 14bar, 120°C
- Compact, easy assembly
- Measuring ranges from 0.7 to 400kg/h

### Measuring principle

Systec deltaflow flow meters work according to the differential pressure principle. This has the advantage of unrivalled robustness and high accuracy. Known disadvantages of the differential pressure method such as pressure losses or low measuring ranges are compensated for at systec by a patented, pressure loss-optimised design of the primary elements and by precise dp wide-range sensors.

deltaflow flow measurements are low-drift and therefore rarely require recalibration. Primary elements used in contaminated media, are - where necessary - designed to be easily dismantled and simple to clean.



- Low pressure losses
- Robust against soiling
- Long-term stable and drift poor

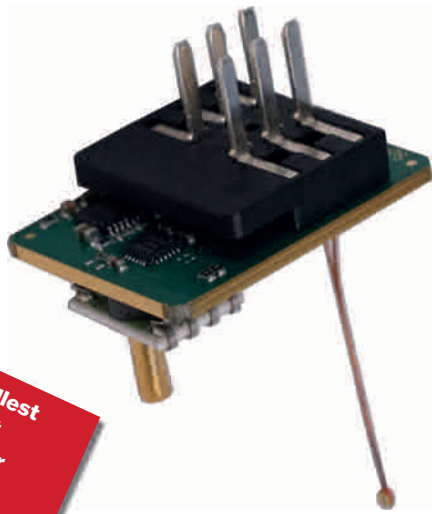
### Patented probe profile

The special feature of the deltaflow profile is its acceleration bends and the sharp break-off edges. Due to the flow-optimised design, the flow accelerates towards the tear-off edge by a factor of approx. 2.3. This increases the differential pressure and keeps the pressure loss small. The calibration constant of the probe - the resistance coefficient - which has a decisive influence on the measured flow value, remains constant.



# FlowB

## How dp measurement works







World's smallest and fastest dp flow sensor for industry.

### State-of-the-art sensor technology

Since 2009, systec has been researching a multivariable sensor platform that is small, robust and fast. The platform combines an absolute pressure, differential pressure and temperature sensor with a  $\mu\text{C}$ -based real-time evaluation on an area of around  $7\text{ cm}^2$ . Thanks to perfectly optimised production and a serial characteristic field calibration, the pressure sensors achieve an accuracy of up to 0.25% and measure the flow up to 2000 times per second. Due to the complete encapsulation of the electronics and the measuring elements, TFI4B is compatible with the vast majority of harmful gases.

This technology is in series use in the TFI4 commercial vehicle air mass sensor and in our deltaflowC and deltaflowB flow sensors.

### Overview table

	Air mass-master	EGR / Blow-by	Exhaust gas master	Air mass for fuel cell	Automotive series Air/EGR/ Exhaust mass flow
					
<b>Type</b>	deltaflowB-air	deltaflowB-EGR	Deltaflow DF25	deltaflowC	TFI4B
<b>Measuring ranges</b>	0..160 kg/h up to 0..13.000 kg/h 0..4.5 bara -40..120°C	0..1 kg/h up to 0..500 kg/h 0..14 bara -40..1000°C	0..160 kg/h up to 0..20.000 kg/h 0..16 bara -40..1200°C	0..15 kg/h up to 0..900 kg/h 0..14 bar -40..120°C	Individually dependent on the venturi design -40..125°C 0..4.5 bara
<b>Accuracy</b>	1% FS 0,5% FS (opt)	2% FS 1% FS (opt)	1% FS 0,5% FS (opt)	2% FS 1% FS (opt)	2% FS
<b>Measuring range</b>	1:10 1:15 (opt)	1:10 1:15 (opt)	1:10 1:15 (opt)	1:10 1:15 (opt)	1:10
<b>Outputs I/O</b>	Measured value computer CAN 4..20 mA opt 0..10 VDC opt	CAN	4..20 mA CAN (opt)	4..20 mA 0..10 VDC CAN (opt)	CAN
<b>Required design data</b>	Contaminants Required measuring dynamics Accuracy requirement maximum Permissible pressure loss				



# Flow measurement technology „by systec“



## deltaflowC

The deltaflowC measures the mass flow of gases in pipes and ducts. Due to the integrated differential pressure, pressure and temperature sensor technology including patented microprocessor technology, measuring accuracies of better than 2% are achieved.

The deltaflowC is particularly characterised by high dynamics, zero-point stability and ease of operation. Practically maintenance-free and at an attractive price, you have your process costs under control with deltaflowC.

## deltaflow volume measurement for gas, steam and liquids

The deltaflow pitot tube has proven itself thousands of times for flow and volume measurement of gases, steam and liquids in pipelines. Averaging pitot tubes have the lowest pressure loss of all differential pressure elements, which allows energy savings of many thousands of euros p.a. in many applications. With its PtB-tested accuracy of up to 0.4% of the measured value, the deltaflow probe can be used reliably even under the most adverse conditions.

The deltaflow is TÜV approved for use in condensing, aggressive and dirty flue gases, is available for pipe diameters from 1 mm - 15 m and a pressure rating of 690 bar and thus covers the vast majority of flow applications.



## deltawaveC ultrasonic flowmeters for liquids

The deltaxwaveC meters are available in two different series: The deltaxwaveC-P for mobile, temporary measurement tasks and the deltaxwaveC-F for permanently installed, continuous measurements.

Both devices use the proven and highly accurate ultrasonic transit time difference method. By using the latest digital signal processors, these robust measuring devices work extremely precisely and drift-free. Thanks to the clamp-on technology, the ultrasonic transducers can be installed within a few minutes. A time-consuming cutting of the pipeline is not necessary. This, and the avoidance of process downtimes, means that deltaxwaveC devices make a decisive contribution to optimising operating costs.



The headquarters of systec Controls is in Puchheim near Munich. Here we develop and manufacture our products according to DIN EN ISO 9001. However, innovation and product quality alone are not enough for us. We have also had our systems tested by independent institutes - with clear and demonstrable

success. By the way: we are also there for you after the installation of your system. Our field service and service technicians will be happy to support you directly on site if you wish. systec Controls - the specialist for flow measurement technology.

Presented by:

**systec**  
CONTROLS

Mess- und Regeltechnik GmbH  
Lindberghstraße 4  
D - 82178 Puchheim  
Tel.: 0 89 / 8 09 06 - 0  
Fax: 0 89 / 8 09 06 - 2 00  
info@systec-controls.de

**systec Controls**  
089 - 809 060

[www.systec-controls.de](http://www.systec-controls.de)